

JLCA Corner (Life Cycle Assessment Society of Japan)

A New LCIA Method: LIME has been completed

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The Ministry of Economy, Trade and Industry has funded a national project of life cycle assessment (henceforth called LCA Project), with a five-year plan starting in 1998 ended in March 2003, which aims to develop a database that will allow industries to easily conduct a highly reliable LCA. This LCA Project includes studies aimed at developing a Japanese version of life cycle impact assessment methods. AIST has developed a **damage-oriented LCIA methodology named LIME** (Life-cycle Impact assessment Method based on Endpoint modelling), for quantifying environmental impacts induced by the occurrence of environmental loading in Japan, as accurately as possible and with a high degree of transparency. The ultimate aim of the project was to publish three lists applicable to LCIA: 1. characterisation, 2. damage assessment, 3. weighting.

1. Characterisation, one of the mandatory steps of LCIA, produces an indicator for each impact category. LIME involves eleven impact categories:

- global warming,
- ozone-layer depletion,
- acidification,
- eutrophication,
- photochemical oxidant creation,
- urban air pollution,
- human toxicity,
- eco-toxicity,
- land use,
- resource consumption and
- waste.

Characterisation factors for local impact categories, except for global warming and ozone-layer depletion, were developed by the LCA project in order to reflect the Japanese environmental background.

2. Damage assessment has a smaller number of safeguard subjects compared with that of impact categories, because many kinds of category endpoints, such as skin cancer caused by ozone-layer depletion, can be aggregated into this safeguard subject. LIME involves four safeguard subjects:

- human health,
- social welfare,
- biodiversity and
- plant production.

DALY (Disability Adjusted Life Year), Japanese Yen, EINES (Expected Increase in Number of Extinct Species) and NPP (Net Primary Production) were adopted as damage indicators for human health, social welfare, biodiversity and plant production, respectively.

3. Weighting, a final step of LCIA, produces a single index as an integrated environmental impact. Conjoint analysis, a powerful technique, so far applied in market research and environmental economics, was adopted in the weighting across safeguard subjects. Two types of weighting factors can be obtained by using this method: the amount of willingness to pay and dimensionless indicators.

The end of March 2003, the development of the first version of LIME has been finished; three types of lists described above will be released in the near future. The characteristics of these steps are different.

A result of characterisation has a comparatively high reliability, because the list of characterisation factors could be developed based on the knowledge of natural science. The result of characterisation, however, might not directly lead us to decision-making (including product selection), as the possibility to meet trade-off relationships is higher owing to a large number of impact categories. In the case of using weighting factors, a single index can be obtained. With this result, it may be easy to apply the other tools of environmental management such as environmental accounting and eco-efficiency, although a single index inevitably involves value judgement. A result of damage assessment can avoid the value judgement as far as possible, while minimising the number of quantified results of LCIA. This result, however, involves higher uncertainty compared with characterisation in general, because further models and parameters have to be introduced to develop damage factors. LCA practitioners can choose the step of LCIA considering these characteristics.

The report that summarises the methodology of LIME has also been submitted to NEDO (New Energy and Industrial Technology Development Organization) and METI (Ministry of Economy Trade and Industry). This report is written in Japanese. There is a plan to translate it into English.

JLCA Corner from 1999 to 2003

- AIST Workshop 'Gateway to Life Cycle Impact Assessment for APEC Member Economies' [8 Int J LCA (2) 2003]
- Impact Assessment Based on the Damage of Safeguard Subjects: Indicators and Methodology for Human Health. Workshop Report [7 Int J LCA (3) 2002]
- Applications of LCA in 'Eco-Products 1999' [5 Int J LCA (4) 2000]
- LCA for Asian Countries and State-of-the-Art of LCA Activities in Japanese Industries [5 Int J LCA (3) 2000]
- Launch of the Damage Function Sub-Committee in the National LCA Project of Japan [5 Int J LCA (2) 2000]
- The Progress of the Database Study Committee in the National LCA Project of Japan [4 Int J LCA (6) 1999]
- The progress of inventory study committee wg2 in the national LCA project in Japan [4 Int J LCA (5) 1999]
- The Progress of the Impact Assessment Study Committee in the National LCA Project of Japan [4 Int J LCA (4) 1999]
- The 3rd International Conference on EcoBalance [4 Int J LCA (2) 1999]